

CLAIMS

1. A control method for a fuel injection system having a spill valve (20), a nozzle control valve (22) and a valve needle (12) which is engageable with a seating
5 to control fuel injection, the method comprising:

applying a first drive current signal (30; 130) to the spill valve (20) to move the spill valve (20) into a closed state and applying a second drive current signal (40) to the nozzle control valve (22) to move the nozzle control valve (22) to an open state,
10 thereby to lift the valve needle (12) from the seating to initiate a main injection of fuel, and

modifying the first drive current signal (30; 130) applied to the spill valve (20) so as to move the spill valve (20) from the closed state to an open state during a spill
15 valve opening period and modifying the second drive current signal (40) applied to the nozzle control valve (22) to move the nozzle control valve (22) from the open state to a closed state during the spill valve opening period, so as to urge the valve needle (12) towards its seating to terminate the main injection of fuel.

20 2. The control method as claimed in claim 1, including switching the first drive current signal (130) off to provide a first actuation pulse (131) to initiate the spill valve opening period and switching the first drive current signal (130) on and then off again to provide a second actuation pulse (132) prior to termination of the spill valve opening period.

3. The control method as claimed in claim 2, including monitoring a glitch detection signal indicative of spill valve opening and modifying the first drive current signal (130) to provide the second actuation pulse (132) at a time, relative to
5 termination of the spill valve opening period, in dependence upon the glitch detection signal.

4. The control method as claimed in claim 3, including monitoring said glitch detection signal periodically during injection events.

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5. The control method as claimed in any of claims 1 to 4, wherein the first drive current signal (30; 130) is modified to cause the spill valve (20) to move towards its open state at a time (t6) of between 0.05 and 2 milliseconds before a time (t7) at which the second drive current signal (40) is modified to cause the nozzle control
15 valve (22) to move towards its closed state.

6. The control method as claimed in claim 5, wherein the first drive current signal (30; 130) is modified between 0.1 and 1 millisecond before the second drive current signal (40) is modified.

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7. The control method as claimed in any of claims 1 to 6, wherein the second drive current signal (40) is switched on to move the nozzle control valve (22) to its open state.

25 8. The control method as claimed in any of claims 1 to 6, wherein the second

drive current signal (40) is switched off to move the nozzle control valve (22) to its open state.

9. A control method for delivering a main injection of fuel followed by a post
5 injection of fuel, the method comprising:

actuating a spill valve (20) and a nozzle control valve (22) to initiate the main
injection of fuel,

10 terminating the main injection of fuel by (i) actuating the spill valve (20) at a first
time to cause the spill valve (20) to move to an open state and (ii) actuating a nozzle
control valve (22) at a second time to cause the nozzle control valve (22) to move
into a closed state,

15 subsequently actuating the spill valve (20) at a third time to cause the spill valve
(20) to move from its open state to a closed state, and

initiating the post injection of fuel by actuating the nozzle control valve (22) to
move into an open state, whereby the difference between the first and third times is
20 selected to provide a relatively high pressure post injection of fuel so as to reduce
smoke emissions levels.

10. The control method as claimed in claim 9, whereby the spill valve (20) is
actuated to move between its open and closed states by modifying a spill valve drive
25 current signal (30).

11. The control method as claimed in claim 10, wherein the relative timing between opening and closure of the spill valve (20) is selected to ensure the post injection pressure is at least 1700 bar.

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12. The control method as claimed in claim 11, wherein the relative timing between opening and closure of the spill valve (20) is selected to ensure the post injection pressure is at least 2000 bar.